CAIT

Center for Advanced Infrastructure & Transportation
Rutgers, The State University of New Jersey

QUARTERLY PROGRESS REPORT

Project Title:	Dynamic Modulus of Hot Mix Asphalt
RFP NUMBER: 2003-10	NJDOT RESEARCH PROJECT MANAGER: NJDOT Project Manager
TASK ORDER NUMBER: TO XXX / RU Acct 4-2xxxx	PRINCIPAL INVESTIGATOR: Ali Maher/Thomas Bennert
Project Starting Date: 01/01/2007 **Original** Project Ending Date: 12/31/2009 **Modified Completion Date:**	Period Covered: 1st Quarter 2007

Task #	Task	% of Total	Fixed Budget	% of Task this quarter	Cost this quarter	% of Task to date	Total cost to date
1	Mobilization	11.19%	$ 25,000	100.0%	$ 25,000	100.0%	$ 25,000
2	Literature Search	2.24%	$ 5,000	100.0%	$ 5,000	100.0%	$ 5,000
3	Develop Test Plan	2.24%	$ 5,000	75.0%	$ 3,750	75.0%	$ 3,750
4	Conduct E* Testing and Database Development	26.85%	$ 60,000	5.0%	$ 3,000	5.0%	$ 3,000
5	Compare Measured E* to Predicted E*	8.43%	$ 18,835	0.0%	$ -	0.0%	$ -
6	Conduct Sensitivity Analysis of E*	15.66%	$ 35,000	0.0%	$ -	0.0%	$ -
7	Conduct Round Robin Testing	11.24%	$ 25,117	5.0%	$ 1,256	5.0%	$ 1,256
8	Develop Final Database	7.83%	$ 17,500	0.0%	$ -	0.0%	$ -
9	Final Report and Quarterly Reporting	14.32%	$ 32,032	0.0%	$ -	0.0%	$ -
10		0.00%	$ -	0.0%	$ -	0.0%	$ -
11		0.00%	$ -	0.0%	$ -	0.0%	$ -
12		0.00%	$ -	0.0%	$ -	0.0%	$ -
13		0.00%	$ -	0.0%	$ -	0.0%	$ -
14		0.00%	$ -	0.0%	$ -	0.0%	$ -
15		0.00%	$ -	0.0%	$ -	0.0%	$ -
16		0.00%	$ -	0.0%	$ -	0.0%	$ -
17		0.00%	$ -	0.0%	$ -	0.0%	$ -
18		0.00%	$ -	0.0%	$ -	0.0%	$ -
19		0.00%	$ -	0.0%	$ -	0.0%	$ -
20		0.00%	$ -	0.0%	$ -	0.0%	$ -
	TOTAL	100.00%	$ 223,484		$ 38,006		$ 38,006

Blue text is entered once at the beginning of the project

Green text is updated ever quarter

Black text is automatically updated or static

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Project Objectives:

The objective of the research project is to provide the NJDOT with a clear understanding of the dynamic modulus test and it precision, the typical E* values of their native HMA materials, and the accuracy of the prediction equations that are proposed for use in the MEPDG.

Project Abstract:

The most critical parameter needed for the upcoming Mechanistic Empirical Pavement Design Guide (MEPDG) is the dynamic modulus (E*), which will be used for flexible pavement design. The dynamic modulus represents the stiffness of the asphalt material when tested in a compressive-type, repeated load test. The dynamic modulus will be the key parameter used to evaluate both rutting and fatigue cracking. The computer software that will accompany the MEPDG will provide general default parameters for the dynamic modulus. However, caution has already been issued by the National Cooperative Highway Research Program (NCHRP) researchers as to the appropriateness of these parameters for regional areas. The major concern is that state agencies will use these default values blindly and sacrifice accuracy of the design. Hence, making the new mechanistic procedure no better than using a structural number (SN) with the old AASHTO method.

To ensure that the New Jersey Department of Transportation (NJDOT) will be prepared for the upcoming design procedure, a research proposal has been developed. The research proposal will encompass evaluating the dynamic modulus of approximately twenty different hot mix asphalt designs that are currently specified by the NJDOT. The dynamic modulus will be determined based on the most current testing protocol (AASHTO TP62). The dynamic modulus (E*) will be represented using a technique called a *master curve*. The E* master curve is a single curve that represents the asphalt materials stiffness relationship to loading frequency and temperature. The master curve for each material tested will be developed and its sigmoidal curve fitting parameters (α, β, γ, δ) determined. This procedure is called Level I for the MEPDG and will provide the most realistic results during design. The measured E* values will be compared to that of the Witczak predictive equation and the Hirsch model. The Witczak predictive equation has been selected by the NCHRP researchers for the Level II and III design. The Level II will provide accurate results, although not as accurate as actually measuring the E* in the laboratory. The predictive equation is based on the mix gradation, asphalt binder viscosity properties, and volumetric properties of the hot mix asphalt. The accuracy of the predictive equation will be determined, as well as possible methods to "shift" the predictive equation to more closely represent New Jersey materials.

Another important aspect of the research project is the development of a "precision-type statement" for use by the NJDOT regarding the dynamic modulus test. Currently, a precision statement does not exist regarding multiple laboratories. Eight laboratories were contacted and asked to participate in a round robin study regarding the dynamic modulus test. All laboratories are AMRL accredited for hot mix asphalt and will provide valuable information regarding the expected precision the NJDOT can expect if dynamic modulus testing is to be conducting by outside laboratories.

1. Progress this quarter by task:

Although the official task order agreement has not be received by CAIT at the time of this quarterly report, work has already begun regarding the round robin testing. For this work, eight laboratories will be participating with the main contact shown in parenthesis; 1) Rutgers Asphalt Pavement Laboratory

(Thomas Bennert), 2) Texas Transportation Institute (Arif Chowdhury), 3) National Center of Asphalt Technology (Brian Prowell), 4) Advanced Asphalt Technologies (Ray Bonaquist), 5) University of Arkansas (Kevin Hall), 6) University of Massachusetts at Dartmouth (Walaa Mogawer), 7) North Central Superpave Center at Purdue University (Becky McDaniel), and 8) Burns Cooley Dennis (L. Allen Cooley).

Each laboratory will be sent enough HMA to construct eight (8) 170mm tall specimens of two different HMA mixes; 1) a 9.5mm Superpave mix with a PG64-22 asphalt binder, and 2) a 25mm mix with a PG76-22 asphalt binder. The individual laboratories will be responsible for compacting six (6) samples (3 of each mixture), coring and cutting to appropriate size based on AASHTO TP62, conducting bulk gravity measurements of the final test specimens, and then testing those specimens according to AASHTO TP62, which is the AASHTO Technical Provisional test procedure to determine the dynamic modulus of hot mix asphalt materials. The HMA designs are currently being determined in-house at Rutgers.

2. Proposed activities for next quarter by task:
Complete the sample preparation of the round robin testing and send the samples out to the laboratories for testing.

Start collecting plant produced HMA mixes for laboratory testing and development of the E* database.

3. List of deliverables provided in this quarter by task (product date):
NA

4. Progress on Implementation and Training Activities:
NA

5. Problems/Proposed Solutions:
NA

Total Project Budget	$223,484
Modified Contract Amount:	
Total Project Expenditure to date	$38,006
% of Total Project Budget Expended	17.01%

NJDOT Research Project Manager Concurrence: _____ Date: _____